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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN No. 54.

B. T GALLOWAY, *Chief of Bureau.*

PERSIAN GULF DATES

AND THEIR INTRODUCTION INTO AMERICA.

BY

DAVID G. FAIRCHILD, AGRICULTURAL EXPLORER.

SEED AND PLANT INTRODUCTION AND DISTRIBUTION.

ISSUED DECEMBER 19, 1903.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1903.

BULLETINS OF THE BUREAU OF PLANT INDUSTRY.

The Bureau of Plant Industry, which was organized July 1, 1901, includes Vegetable Pathological and Physiological Investigations, Botanical Investigations and Experiments, Grass and Forage Plant Investigations, Pomological Investigations, and Experimental Gardens and Grounds, all of which were formerly separate Divisions, and also Seed and Plant Introduction and Distribution, the Arlington Experimental Farm, Tea Culture Investigations, and Domestic Sugar Investigations.

Beginning with the date of organization of the Bureau, the several series of Bulletins of the various Divisions were discontinued, and all are now published as one series of the Bureau. A list of the Bulletins issued in the present series follows.

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[Continued on page 3 of cover.]

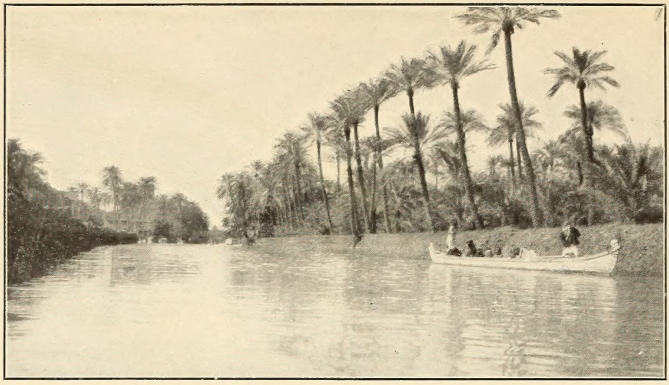

FIG. 1.—CANAL THROUGH DATE PLANTATION AT BASSORAH.

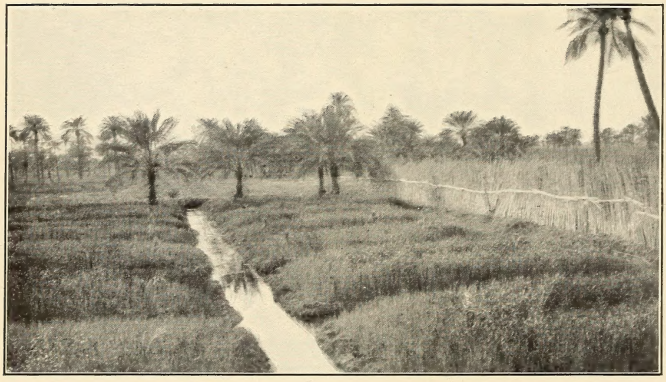

FIG. 2.—NEW DATE PLANTATION, SHOWING IRRIGATION DITCHES.

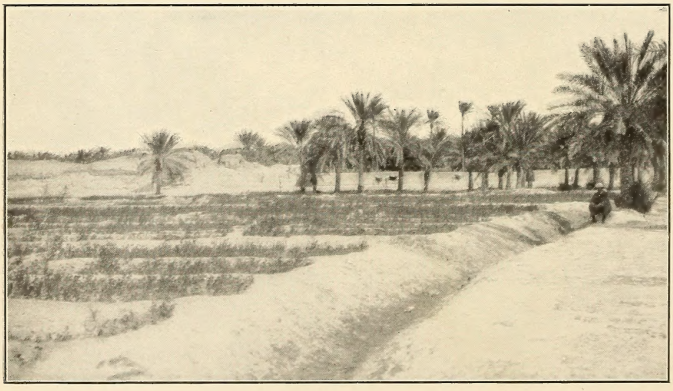

FIG. 3.—AT THE BORDER OF IRRIGATION; PATCHES OF ALFALFA.

U. S. DEPARTMENT OF AGRICULTURE.

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1903.

BUREAU OF PLANT INDUSTRY.

BEVERLY T. GALLOWAY, *Chief of Bureau.*

SEED AND PLANT INTRODUCTION AND DISTRIBUTION.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., October 17, 1903.

Sir: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 54 of the series of this Bureau the accompanying paper entitled "Persian Gulf Dates and Their Introduction into America."

This paper was prepared by Mr. D. G. Fairchild, Agricultural Explorer, and has been submitted by the Botanist in Charge of Seed and Plant Introduction and Distribution with a view to publication.

The information contained in this bulletin and a collection of young date palms which were imported and are now growing in the Government date orchards in Arizona form another of the many generous gifts which Mr. Barbour Lathrop, of Chicago, has made to the American people.

The four half-tone plates are essential for the purposes of this bulletin.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

PREFACE.

The importance of introducing the commercial culture of the date palm into Arizona and California led to the establishment of the cooperative date orchard at Tempe, Ariz., where already more varieties of this palm are gathered together than are to be found in any other one place in the world. To the original orchard additions have been made from time to time, one of the most important being the collection of Persian varieties presented to the Department of Agriculture by Mr. Barbour Lathrop and described in the present bulletin. Fortunately, many of the suckers sent from Persia are alive and will in time enable the Department to distribute the best of these varieties in suitable regions of our arid Southwest.

Mr. Fairchild's statements regarding the manner in which the Persian dates are packed furnishes an additional incentive for pushing the work of introduction, so that the home market may be supplied with clean, wholesome dates.

In securing much of the information which is contained in this bulletin and in the procuring of the young date palms Mr. Fairchild is indebted to the American vice-consul, Mr. A. Mackirdy, of Maskat, Mr. Rudolf Hürner, vice-consul, of Bagdad, Mr. O. Gaskin, British vice-consul, of Bahrein, and especially for unusual courtesies and aid to Mr. H. P. Chalk, of Bassorah.

A. J. Pieters,
Botanist in Charge.

Office of Botanist in Charge of Seed
and Plant Introduction and Distribution,
Washington, D. C., September 17, 1903.

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PERSIAN GULF DATES AND THEIR INTRODUCTION INTO AMERICA.

INTRODUCTION.

The valley of the Euphrates is said to be the birthplace of the date palm. Whether this is true or not, it is certain that nowhere else in the world are more favorable conditions for the cultivation of the date to be found than along the shores of the Persian Gulf and in Lower Mesopotamia.

The Persian Gulf date region is doubtless the largest in the world and furnishes the greatest part of all the dates sold in the American markets. Two million cases, or over a hundred million pounds of dates, have been exported in a single year from the principal shipping port; and at a very moderate estimate—for no even approximate data are obtainable—there must be not less than fifteen to twenty million date palms in this great territory.

The date plantations of Biskra, in the Sahara, contain little over half a million palms, according to Swingle,[a] while the immense region comprising Upper and Lower Egypt together is estimated by Willcocks[b] to have only 7,400,000 date palms in cultivation. Moroccan and Spanish gardens are insignificant in comparison with these great regions, and no one connected date area can compare in size with the plantations which extend for 70 miles in an unbroken forest from below Mohammerah to above Kurna, on the Shat-el-Arab River. This strip of forest varies in width from less than a mile to over 3 miles, and more than 5,000,000 trees, it is estimated, are packed into it. There is certainly nothing comparable to it in the world, either as regards size or the ease with which it can be irrigated.

Date growing in Arizona is rapidly passing the experimental stage. The fact that this fruit could be grown there, however, was first called to the attention of the public by the success of a number of chance seedlings which bore good crops of fine fruit. The seeds from which

[a] Swingle, W. T. The Date Palm and its Culture. In Yearbook of Department of Agriculture for 1900, p. 461.

[b] Willcocks, W. Egyptian Irrigation, 1899, pp. 17–18.

these seedlings were raised came probably from Persian Gulf dates, since these are the most common ones in our markets. The excellence of the fruit from these seedlings and the fact that they ripened early made it seem probable that the Persian Gulf dates, as a class, might prove upon investigation to ripen earlier than those of North Africa, and therefore be better suited to the short, hot seasons in Arizona.

The stickiness of the dates from Mesopotamia, as sold in this country, is perhaps a disadvantage which they have in comparison with the African sorts, but it was thought that American date firms might not wish to import the best varieties and that there might be found under cultivation along the coast of the Persian Gulf superior early-ripening sorts of which nothing is now known in the United States.

The consideration of these possibilities decided Mr. Barbour Lathrop to send the writer up the Persian Gulf to Bagdad to look for the best and earliest varieties of dates and to secure such information regarding their culture as might be obtainable. The object of this short bulletin, therefore, is to make available to those interested in date culture the information, more or less fragmentary, which was secured during a brief stay in Bassorah and Bagdad and stops of a few hours at ports on the Persian Gulf.

GENERAL DESCRIPTION OF THE REGION.

The Persian Gulf, like the Red Sea, is a body of unusually salty water, surrounded by stretches of desert sand and barren hills and cliffs. Its waters are shallow and easily and often ruffled by storms, making landing on the shelving beaches sometimes difficult and dangerous. Its eastern shore is formed by the rocky coast of Persia, while the deserts of Arabia constitute its western coast. The Gulf of Oman is separated from the Persian Gulf by a narrow strait, south of which lies the Sultanate of Maskat, with its dependent province of Guadur on the opposite side of the gulf.

The Shat-el-Arab River is formed by the union of the Tigris and Euphrates at Kurna, where, according to the Arabs, the garden of Eden was located. It flows south for 70 miles and empties into the northern end of the Gulf of Persia, forming a shallow bar which must be crossed at flood tide by even shallow-draft vessels.

The Persian Gulf is politically controlled by Great Britain, whose officials settle petty intertribal disputes between the natives and push the interests of British trade by increasing the communication facilities of the waterways. Turkey nominally governs Arabia, but practically controls little territory south of the Shat-el-Arab River, while the Shah of Persia has jurisdiction over the whole eastern coast of the gulf, and the Sultan of Maskat, under the eye of Great Britain, manages the affairs of his Sultanate and of his dependency of Guadur.

Developments in this region have until recently been very slow, but those who read the signs of the times there foresee some interesting changes in the near future.

There are several ways in which the Persian Gulf region may be visited: By comfortable steamers of the British India Line from Bombay, which run weekly and form the easiest and quickest approach; by caravan from Damascus, in fourteen days, to Bagdad; by carriage from Trebizond to Mosul and down the Tigris (on a raft of inflated sheepskins) to Bagdad; via Teheran and Ispahan on mule back to Bushire or Bagdad; or by the Anglo-Arabian and Persian Steamship Company, of Leadenhall street, London, which keeps up a fairly good service to and from the gulf. This company runs steamers at least once a month, and frequently semimonthly, stopping at Port Said, Suez, and Aden.

The Turkish quarantine regulations at Bassorah require of all passengers on boats from India ten days' quarantine, while only five are demanded of this Anglo-Arabian Company coming direct from Europe. The easiest way, therefore, to reach the gulf will be to join one of this company's boats at Port Said, Suez, or Aden. Returning, one can take a boat of the British India Line to Bombay, if he desires to call at any of the ports on the coast, which are closed by quarantine to boats going up to Bassorah but open to all steamers returning from there.

CLIMATE.

The Persian Gulf and the Gulf of Oman are among the hottest regions in the world. Maskat, while not as warm as Jacobabad, is so hot that the thermometer registers 117° to 120° F. in the shade, and for nights and days the temperature has been known to remain somewhere about 110° F. The sea water in the harbor, as taken for the ship's engines, was registered on the log of the steamer as 96° F., and the eight Europeans who live in the place, in order to make sleep a possibility, resort to the use of special machines, like fanning mills, which force a draft of air through a perpetually wet screen. As high as 124° F. in the shade is recorded for the river Shat-el-Arab by the "Persian Gulf Pilot." The Europeans spend as much time as possible during the day in darkened, lower-story rooms, and the nights on the flat roofs of the houses. Nor is the heat by any means always a dry one, but it is often muggy and oppressively moist. The winters are as delightful, with their bright sunshine and cool breezes, as southern California. The rainfall is about 6 inches, according to Mr. Mackirdy, United States vice-consul, and occurs in the spring months. No rains fall during the principal date harvest in August and September, which are at the same time the hottest months. Owing to this long, excessive heat at Maskat the dates ripen earlier than they do farther north.

At Bahrein (the pearl islands), on the Arabian side of the Gulf, Rev. S. M. Zwemer, who has the self-registering thermometer of the Indian weather service, describes March, April, October, November, and December as "delightful," with indoor temperatures seldom above 85° F. or below 60° F. January and February are colder, even cold enough for a fire, and in these two months the rain of the season usually falls. The months from May to September form the hot season, and during this period heavy night dews are common and the thermometer often remains above 100° F. for many days and nights together. The minimum temperature in the village of Menamah, Bahrein, during the summer months of 1893 was 85° and the maximum 107° F. in the shade.

In Bassorah, near the mouth of the Shat-el-Arab, the climate is similar to that of Bahrein, with the exception that the winters are colder—so cold, in fact, that a grate fire is necessary for comfort. Such delicate plants as tropical guavas are injured by the low temperature.

Bagdad is still some distance from the northern limit of date culture, and yet frosts are of frequent occurrence. Temperatures of 17° and even 12° F. it is understood have been observed, though not by official weather observers. The summers are cooler than at most places on the gulf, and shortly after sunset the rapid radiation from the desert which surrounds the town lowers the temperature appreciably. Judging from the glare upon the light-brown soil in the winter season and from the precautions which it is necessary for travelers to take in crossing the deserts, the insolation to which the date palms are subjected in Mesopotamia must be something extraordinary. No figures regarding the force of the sun's rays, however, were obtainable.

From Mr. Willcocks's paper, cited later, the following tables are taken:

Meteorological observations at Bagdad.

Month.	1888				1894			
	Temperature.		Rainfall.		Temperature.		Rainfall.	
	Mean maximum.	Mean minimum.	Mean.	Total.	Mean maximum.	Mean minimum.	Mean.	Total.
	° F.	° F.	Inches.	Inches.	° F.	° F	Inches.	Inches.
January	62.5	41.1	49.9	0.1	55.5	37.1	46.3	1.5
February	68.1	47	54.9	2.4	61.5	44	52.8	7.9
March	74.2	51.7	60.5	.8	69.3	50.4	59.8	4.4
April	81	58.7	68.8	2.7	76.2	58.9	67.5	2.5
May	94.1	70.2	80.1	.7	91	69.9	80.5	.....
June	102.2	76.9	88.3	.....	100.3	76.9	88.6	.....
July	109.3	80.2	92.6	.....	105.3	78.5	91.9	.....
August	106.3	78.6	90.9	.....	106.7	79.3	93	.....
September	103.4	72.8	85.7	.....	100.3	70.5	85.4	.....
October	100.2	69.1	79.1	.....	90	61.2	75.6	.1
November	74.8	48.3	57.3	1.2	72.1	55.1	63.6	4.8
December	60.8	42.3	49.1	.5	61.5	44.8	53.2	1
Mean	87.9	61.4	71.4	8.4	82.5	60.5	71.5	22.2

Meteorological observations at Bagdad—Continued.

Month.	1899				1900			
	Temperature.		Rainfall.		Temperature.		Rainfall.	
	Mean maximum.	Mean minimum.	Mean.	Total.	Mean maximum.	Mean minimum.	Mean.	Total.
	°F.	°F.	*Inches.*	*Inches.*	°F.	°F.	*Inches.*	*Inches.*
January	58.7	38.8	48.8	0.3	60.4	39.5	49.9	0.4
February	67.2	43.2	55.2	.1	66.4	45.9	56.1	1.2
March	73.5	49	61.3	.5	72.7	53.7	63.3	1
April	87	61.3	74.2	.3	85.8	61.7	73.8	.....
May	96.7	68.9	82.8	.....	93.3	66.2	79.9	.....
June	104.5	76.5	90.5	.....	103.5	73.8	88.7	.....
July	110.5	79.5	95	.....	108.2	77	92.6	.....
August	112.1	79.4	95.7	.....	108.6	76.1	92.4	.....
September	107.3	73.2	90.3	.....	105.1	71.3	88.2	.....
October	92.5	64.2	78.4	.1	93.2	65.4	79.3	.....
November	72.3	47.9	60.1	1.1	71.8	49.2	60.5	1.7
December	58.3	39	48.9	1.2	64.5	44.8	54.7	1.4
Mean	86.7	60.1	73.4	3.6	86.1	60.4	73.4	5.7

Month.	1901				1902			
	Temperature.		Rainfall.		Temperature.		Rainfall.	
	Mean maximum.	Mean minimum.	Mean.	Total.	Mean maximum.	Mean minimum.	Mean.	Total.
	°F.	°F.	*Inches.*	*Inches.*	°F.	°F.	*Inches.*	*Inches.*
January	57	38.2	47.6	0.5	62	36.9	49.5	0.2
February	75.1	47.2	61.2	.....	73.7	47.6	60.6	.4
March	82	54.7	68.4	.3	73.2	51.3	62.3	1.8
April	89.3	61.6	75.4	.2	84.3	60.2	72.3	1.9
May	95.1	67.2	81.2	.2	99.6	71.9	85.7	.....
June	108.8	78.2	73.6	.....	107.4	76.9	92.2	.....
July	113.5	80.5	97	.....	.....	.....	.....	.....
August	113.1	80.9	97	.....	.....	.....	.....	.....
September	108	74.6	91.3	.....	.....	.....	.....	.....
October	93.8	63.2	78.5	.....	.....	.....	.....	.....
November	78.9	54.2	66.9	.1	.....	.....	.....	.....
December	68.3	43.1	55.7	.2	.....	.....	.....	.....
Mean	90.2	62	74.5	1.5	.....	.....	.....	.....

LOCATION OF THE DATE GARDENS.

Although the Arab knows more about dates than he does about any other plant, since it is his principal food, his knowledge is generally very local, and it is difficult to obtain accurate information regarding the extent of the date plantations along the gulf.

It is probable that small gardens are to be found almost anywhere on the coast where the water necessary for cultivation is obtainable, but there are several principal regions from which the dates are exported or have otherwise become well known. How large they are is, however, the subject of conjecture.

The Pangh Ghur region, lying thirteen days' caravan ride inland from the port of Guadur, on the Gulf of Oman, is in the Mekran territory of Baluchistan. According to Lieut. W. O. Grant, of the First Baluchistan Light Infantry, who recently took an expedition into the country and to whom the writer is indebted for much valuable information, the plantations in this region are of considerable size, including hundreds of thousands of trees; but the natives export

into Kurrachee and other parts of India only small quantities of dates. Among them, however, is one of the finest in the world, called the "Mozaty," which is packed in date sirup in small earthen jars and is sold as a great delicacy on the Kurrachee market. Little is known about the other varieties of this region, except that they are reported to ripen very early, even as early as June. A guard is necessary in order to visit the region, as the inhabitants are quite uncivilized and are continually at war with each other.[a] Maskat itself has few palms in its immediate vicinity, but some 50 miles in the interior, at Semail, at least half a million trees are said to be under cultivation, while along the Batna coast is a region which, according to Vice-Consul Mackirdy, is 60 miles long and a half mile wide and is packed with date palms. These two areas are believed by Mr. Mackirdy, who is an old resident in Maskat, to nearly equal in size those of Bassorah and Mohammerah. They furnish 1,000 tons of dates for export to America and the total yearly export from Maskat is estimated roughly at 30,000 tons, which is second only to Bassorah in amount. Maskat has the largest date export from the gulf to Indian and other Asiatic ports. Owing to its southern latitude and excessive heat the dates of Maskat ripen earlier (some of them in June) than those farther north.

Back of Jask, which lies on the opposite coast of the Gulf of Oman, large gardens of dates are said to exist, but about the place itself scarcely a palm is to be seen, and the surroundings of the latter are almost a complete desert. Six days' camel ride into the interior, at a place called Bashkala, some especially fine varieties are grown and, according to Mr. G. W. Mongavin, of the Indo-European telegraph department, who was stationed for some years at Jask, the dates from this region are the finest he has ever tasted. How extensive the orchards are is unknown. Forty miles from Bunder Abbas, on the Persian coast, are the plantations of Minab, which are almost as large, it is said, as those of Bassorah and Mohammerah. These are the plantations which furnish the dates for consumption on the Persian Gulf, and, in the picking season, which is in June and July, the inhabitants of many small villages along the coast migrate to Minab, where dates are much cheaper than at home, to live for several months. The varieties, in part similar to those of Maskat and Bassorah, are inferior in flavor and keeping quality. Those tasted, late in the season it is true, had decidedly harsh skins, and were inferior in every way to any of the good Bassorah sorts.

The town of Lingah, in Persia, which owing to the quarantine restrictions was seen only from the steamer, is fringed with date

[a] The native servant, whom Lieutenant Grant was kind enough to dispatch to Pangh Ghur in search of palms for the expedition, was turned back at Kej, some seven days' caravan journey from the former place, but luckily secured at Kej palm shoots, which the chief of the place reports are of the Pangh Ghur variety "Mozaty."

palms, but it was not learned that any fruits were exported or that any considerable area was planted to dates. The people of Lingah are said to obtain most of their dates from Minab.

Bahrein Island, noted as the center of the pearl fisheries of the gulf, has itself a half-million date palms planted on it, but they are not much more than enough to supply local gulf demands, neither are they of superior quality. The region of Hassa, however, 60 miles inland, has extensive plantations and produces one of the most delicious dates of this part of the world, called the "Khalasa of Hassa." Zwemer, in his "Arabia, the Cradle of Islam," remarks that the Hassa date region is not comparably as large as that of Bassorah, but he does not tell how extensive it really is. Probably a million trees would be a fair estimate.

Bushire has few date palms about it, but the districts of Tangistan and Koweis, not far off, have plantations of considerable size, it was stated by an old resident of the place. Three or four hundred tons of dry dates are exported annually to India from this port.

Of the date gardens of Koweit nothing was learned, but they are probably inconsiderable in size.

Mohammerah and Bassorah, although 30 miles apart and on opposite sides of the Shat-el-Arab which separates Persia from Arabia, really belong to the same general district and are the centers for export of the largest single date-producing region in the world. Although no count has ever been made, there are probably over five or six million palms planted along the banks of the river, and as seen from the bridge of a steamer the waving crowns of these tall palms stretch away in every direction to the horizon. (Pl. II, fig. 1.) In reality, the strip of land occupied by them is from less than a mile to 3 or 4 miles wide and 70 miles long, with occasional rice fields or neglected areas.

At various places along the Tigris and Euphrates, which rivers run almost parallel to each other across the broad, slightly inclined plain of Mesopotamia, there are date plantations varying in size from a few trees to hundreds of acres. About Bagdad, 535 miles from Bassorah, and at Hillah, on the Euphrates, a day's journey by camel from Bagdad, there are extensive groves of dates—over a million trees in the two places—and numerous superlative sorts are produced here, such as the "Kustawi," "Maktum," "Taberzal," etc. Owing to the fact that there is little export to restrict the number of varieties which may be planted for profit, there are probably more different kinds to be found about Bagdad than anywhere else in the Persian Gulf region.

SOIL CONDITIONS.

The date loves a slightly alkaline soil and can thrive where enough salt is present to kill most ordinary plants. It finds in the countries

around the Persian Gulf all degrees of saltiness. The writer was unable to obtain good samples of the soil from all of the noted date regions about the gulf but examined a sufficient number to satisfy himself of its variability. In Bassorah there is an adobe soil, resembling the silt of the Nile Valley, so sticky that it has only to be dried in the sun to make the best of adobe bricks. This pure adobe is not considered as suitable a soil as that which has a slight admixture of sand in it to make it lighter. Though undoubtedly a fine soil, this alluvium can not be compared with the rich river bottoms of the Missouri, Kansas, and Mississippi, and is able to produce no such crops of maize or wheat. The soil of Bagdad resembles that of Bassorah closely, being made up of the same alluvial deposits from the Tigris River. Not a stone the size of a man's fist can be found by searching for hours across the plains about Bagdad, and the broken antique pottery, tiles, and bricks attest the character of the fine-grained soil of which these millions of acres are composed. It is the very soil of which Babylon was built, and which when baked has so well preserved for later generations the cuneiform language of the Babylonians.

IRRIGATION OF THE PLANTATIONS.

Nowhere in the world does such an ideal water supply exist for the irrigation of date plantations as at Bassorah. A broad, muddy river, flowing at a rate varying from 0.4 mile to 6 miles an hour between banks which are so low that the Arabs sit upon them and wash their hands in the stream (Pl. IV, fig. 3), supplies an almost unlimited quantity of water. With each high tide the waters of the river are backed up for about 70 miles and rise on an average at Bassorah 6 feet above their former level, filling on both banks the hundreds of irrigating canals which run in every direction for many miles through the date forests. The height of the river at Bassorah changes little, summer or winter, though its level at Bagdad, 535 miles away, falls materially during the dry summer months. A strong southerly wind, if blowing up river for some time, will, together with the rising tide on the bar, raise the level of the water a foot or more over its natural high tidal mark.

Occasional large canals extend for more than 2½ miles into the desert at right angles to the river and give off numerous side canals. These mains are navigable by large steam launches and form the avenues by which dates are transported to the steamers that lie in the river during the shipping season. These large canals, planted for their whole length with palms, are in fact like rivers through a great forest of dates. The land is so level that apparently no engineering difficulty lies in the way of an immense extension of this canal system so as to take in thousands of square miles of this rich alluvial desert which stretches away to the horizon from the comparatively narrow strip of

already utilized land fringing the river banks. The writer followed up one of the main canals and reached the end of the irrigation ditches to find, on the very border of the desert, luxuriant patches of alfalfa and fine looking 10-year-old date palms. (See Pl. I, fig. 3.) The Arabs are gradually, but very slowly, lengthening the canals and watering more desert every year. A great impetus was given to date culture in Mesopotamia by the opening of the Suez Canal in 1869. This brought the European and American markets within easy reach by water, and enabled the growers to get their dates to London and New York in time for the autumn market, avoiding the expense and delays of their transportation by camel across the desert. Large areas of palms which were planted at that time are now in the prime of their productiveness.

The method of planting is determined by the irrigating ditches, which are large (often 3 feet by 3 feet) and cut the ground up into small rectangular peninsulas, 10 to 15 by 20 to 30 feet in size. (Pl. I, fig. 2, and Pl. II, fig. 2.) On each peninsula 2, or sometimes 3, palms are set. (Pl. VII, fig. 1.) Often the peninsulas are much larger and hold from 4 to 5 and even as high as 10 palms. The size of these peninsulas depends somewhat upon the permeability of the soil and the height to which the irrigation water rises in the ditches. On an average 100 palms are planted to a "djerib," which unit of measure is a trifle less than an acre. In order to prevent the waters receding too quickly from the canals when the tide falls, dams of mud are built, and pipes, or the hollow trunks of palms, are run through them, which permit the water forced into the canals by the rising tide to flow away slowly. The length of time during which the canals are filled with water is more or less under the control of the proprietor, and as the supply is practically unlimited no tax of any kind is paid nor is any regulation necessary regarding its use. In short, the Bassorah date grower has only to see that his ditches are kept in order, which is an easy matter where the soil is as pure adobe as the clay of a brickyard and the backwater of the river will fill and empty them twice every twenty-four hours. The conditions of this form of irrigation, which might be called a tidal one, are quite ideal and so far as known are found on such a scale nowhere else in the world. Professor Hilgard, of the California Experiment Station, says that the waters of the Sacramento River are being utilized in a similar way, but on no such scale. With the proper extension of the canals on both sides of the river an area covering several million acres could, it is believed, be planted to dates and the Bassorah region might then supply the dates of the world.

Conditions in Bagdad are quite different. The banks of the Tigris are high, often 20 feet or more, and even at its highest level the water never flows into the irrigating canals, but must be lifted laboriously by means of contrivances of Babylonian antiquity, called "chirds."

These are composed of a set of pulleys, a bullock-skin bag holding 20 to 40 gallons, and a rope attached to a horse or bullock, which walks laboriously up and down a steep dirt incline, hoisting the water as it descends and lowering the bag into the river as it backs up the declivity. (Pl. IV, fig. 2.) None of our unpicturesque but practical Yankee windmills, with their ugly shapes, has yet invaded the banks of the Tigris, although during the spring season, when the water is most required, strong, steady breezes are almost constantly blowing. Once lifted into small, shallow reservoirs, the water is led off by trenches and manipulated in the usual way, giving each palm a periodic watering by filling its particular trench.

What the irrigation conditions in this region were when Babylon was a great city and the whole country was as thickly populated as Egypt is to-day can be judged by a study of the remarkable ruins of the great canals and dams which are to be found in this now desolate country.

Sir William Willcocks, K. C. M. G., whose name is so well known from his remarkable work on the Assuan dam in Egypt, has recently made a study of the old canal system of Chaldea and has drawn a most vivid picture of the irrigation system of ancient Babylon.[a] He shows how favorably it compared with the system of ancient Egypt, and points out in the following words the cause of the destruction of its greatest canal, the Nahrawân, and the consequent widespread desolation which was produced:

> What was the real cause of the ruin of all this agricultural wealth and these great cities, and the creation of the vast deserts which we see to-day? An examination of the map will make it evident. Those who have seen the headworks of the Ganges Canal at Hardwar in northern India, where the rubble weirs across the shingly bed of the Ganges lead the stream past Hardwar into the Ganges Canal above the steep bluffs of Kankhal, will readily understand what I am going to say. Let such imagine what would be the fate of the great Ganges Canal if the Ganges River were to desert the Hardwar channel, flow down the Budh Ganga, and then turning abruptly westward eat away the Kankhal bluffs until the canal was cut into by the river. It would mean ruin to the whole canal with its 500 kilometers of main channels and 3,500 kilometers of minor channels. Such a fate has overtaken the Nahrawân Canal.
>
> The Tigris has a mean width of under 400 meters, according to information kindly supplied me by M. Moritz, librarian of the Khedivial Library at Cairo, while the lower heads of the Nahrawân Canal have a mean width of about 100 meters each, according to the plans of Commander Felix Jones. To insure the supply of this great canal we are, moreover, informed that the Tigris has constructed across its ancient bed, downstream of the intake of these feeder canals, massive rubble weirs. To me it seems conclusive that, in Chaldea's evil day, the main stream of the Tigris deserted its ancient bed, followed the scoured and degraded bed of the canal whose regulating head had been swept away, and cut out a new channel for itself at right angles to its old course. A careful examination of the plans and levels can lead to no other conclusion. Once the river had changed its course, the old bed gradually

[a] Willcocks, Sir William. The Restoration of the Ancient Irrigation Works on the Tigris. Cairo, National Printing Department, 1903.

silted up, the river ate away the feeder canal at the site of the regulator whose ruins to-day are in the bed of the river, and again ate away the main Nahrawân itself between the seventieth and eightieth kilometers. The ruin was complete. Feeble hands did what they could to repair the disaster. The Beldai dam across the Dyâla was strengthened and the head of the Nahrawân Canal was removed to its one hundred and fifty-second kilometer. The feeble supplies of the Dyâla River could alone be depended on, the Tigris gave no aid from its ample waters, and a once flourishing and world-renowned region became a desert. The ruin on the west bank was equally great. The weirs which had held up the waters of the Tigris in order to feed the canals were turned and the mighty canals dwindled away into the feeble water courses of to-day. Commander Felix Jones well observes: "The summit of Opis, as we gaze around, affords a picture of wreck that could scarcely be conceived if it were not spread at the feet of the beholder. Close to us are the dismembered walls of the great city, and many other mounds of adjacent edifices spread like islands over the vast plain, which is as bare of vegetation as a snow tract and smooth and glass-like as a calm sea. This appearance of the country denotes that some sudden and overwhelming mass of water must have prostrated everything in its way, while the Tigris, as it anciently flowed, is seen to have left its channel and to have taken its present course through the most flourishing portion of the district, severing in its mad career the neck of the great Nahrawân artery, and spreading devastation over the whole district around. Towns, villages, and canals, men, animals, and cultivation must thus have been engulfed in a moment, but the immediate loss was doubtless small compared with the misery and gloom that followed. The whole region for a space of 420 kilometers, averaging about 30 kilometers in breadth, was dependent on the conduit for water, and contained a population so dense, if we may judge from the ruins and the great works traversing it in its whole extent, that no spot on the globe perhaps could excel it."

Of those who were spared to witness the sad effects of the disaster, thousands, perhaps millions, had to fly to the banks of the Tigris for the immediate preservation of life, as the region at once became a desert where before were animation and prosperity. The ruin of the Nahrawân is indeed the great blow the country has received. Its severity must have created universal stupor, and was doubtless followed by pestilence and famine of unmitigated rigor, owing to the marshes which accumulated annually in the absence of the dams on each spring rise of the river.

It is interesting to read what the trained imagination of Mr. Willcocks foresees will be the result of the restoration of these ancient irrigation works on the Tigris and his entirely preliminary estimate of the expense necessary to restore them. An outlay on canals and repairs of £8,000,000, he figures, will throw over a million and a quarter acres under cultivation, raise the value of the land which is now worthless to $150 per acre, and pay a profit in rentals of 25 per cent per annum on the investment of $40,000,000.

On page 17 of the volume cited Mr. Willcocks remarks:

To enable a true estimate to be made of the exact nature of the works and their cost, there lies much information to be collected by brigades of engineers working under a capable chief—such information as only experts can gather through months of patient observation and field work—exact gauge readings of the Tigris, Antheim, and Dyâla rivers; discharge diagrams; analyses of the waters of the rivers; field maps of the soils; contoured maps of the country on which to lay down the alignments of the canals, and the dimensions of the cross-drainage works; soundings of the rivers and borings of their beds; examination of the building materials available

to enable designs to be made of regulators and escapes, weirs and locks, syphons and superpassages, and all the details which accompany a well-conceived project. Such works it will take a couple of years to collect; but I have not considered it unwise, with the aid of experience and prescience acquired in a lifetime of devotion to irrigation works, to make a rough preliminary estimate of what such works would cost and what would be their probable results, so as to encourage capital to pay for the collection of that detailed information whose outlines I have just described.

The area of first-class land, waiting only for water to yield at once a handsome return, I estimate as follows:

	Acres.
West of the old Tigris	280,000
Between the old and new Tigris	160,000
East of the Tigris, north of Bagdad	420,000
East of the Tigris, south of Bagdad	420,000
Total	1,280,000

The cost of the works, discounting all assets, I estimate roughly as follows:

Main canal, 200 kilometers by 500 square meters.....cubic meters	100,000,000
Earthwork, main canal	£2,000,000
Weirs on the Tigris	600,000
Masonry works, main canal, one-half the earthwork	1,000,000
Minor canals, 1,280,000 acres, at £3 per acre	3,840,000
Total	7,440,000
Add contingencies	560,000
Grand total	8,000,000
Cost per acre (£8,000,000 ÷ 1,280,000)	£7
Value of the land (1,280,000 acres, at £30)	38,400,000
Rent per annum (1,280,000 acres, at £3)	3,840,000

If of this sum nearly half is spent in maintenance of the canals, we have a net return of £2,000,000 per annum, or 25 per cent on £8,000,000 of capital. Let those who know Egypt say whether they consider such figures as too sanguine.

The date region of the island of Bahrein is watered by several most remarkable springs, the fresh water of which must reach the island by submarine water courses. The largest of these springs is 100 feet across and 27 feet deep, and flows a 2-mile-an-hour stream, with a cross section of 2 by 8 feet, or about 16,000 gallons per minute. This spring alone waters, the British vice-consul, Mr. Gaskin, states, about a half million date palms and if completely utilized could water almost as many more.

In Hassa, on the mainland, there are underground water courses, and the date palms which furnish the famous Khalasa date probably get their water from these underground sources. Zwemer describes vast areas in this region, now quite destitute of vegetation, where 3 or 4 feet below the surface an abundance of sweet water is obtainable.[a]

The river Lowadi flows through Minab, and the plantations of this date region are irrigated by it, according to the statement of a resident of Bunder Abbas, the nearest port.

[a] Zwemer, S. M. Arabia, the Cradle of Islam. New York, 1901, p. 112.

The method of irrigation used in the Pangh Ghur region, where the famous Mozaty date is grown, must be most peculiar, for, according to Lieutenant Grant, the system of canals is largely subterranean, and innumerable wells tap these underground water courses, which are tunneled through the soil at great expense. The levels are so carefully studied that land which is apparently, though not really, at a higher elevation than the supply well is furnished with water.

SECONDARY CULTURES BETWEEN THE PALMS.

One may look in vain for a cover crop in use in the date plantations. The use of leguminous plants to enrich the soil seems to be unknown, and although alfalfa (called "djet") is grown in diminutive patches to furnish food for the horses, the fellah, or Arab cultivator, is generally ignorant of its value for enriching the soil. Wheat and barley are often sown among the palms, but furnish an inferior product. (Pl. II, fig. 2, and Pl. IV, fig. 1.) The planting of grapevines has been most successful in Bassorah, and the palm stems form quite as admirable supports between which to train the vines as do the trunks of the mulberry trees in the groves of Italy and the Tyrol. The light shade furnished by the trunks and crowns of the palms appears to be none too much to protect the vines from the excessive glare and heat of the sun, and most excellent table sorts of grapes are produced. Other fruit trees, such as figs, jujubes, and pomegranates, are also frequently seen about the houses, and thrive very well. Altogether, however, there is a barrenness about these palm forests which reminds one of the Australian bush.

TREATMENT OF THE SOIL AND PLANTING OF YOUNG PALMS.

Though pure silt, like that of the Nile Valley, the soil on the Shat-el-Arab is manured to make it more productive and, whether rightly or wrongly, only cow manure is considered suitable, that from the horse stables being regarded as too heating. Such things as artificial fertilizers are quite too modern for Arabia, and the value of wood ashes and bone dust is scarcely appreciated.

Just before a plantation is set out with suckers the soil is dug over by hand to a depth of 18 inches, and this digging is repeated every four years. Weeding is done when necessary and the surface of the ground occasionally stirred, but aside from this primary treatment the soil is given very little attention.

In the matter of propagation the Arabs of Mesopotamia are more advanced than the Egyptians, for they have learned the practical advantage of employing small suckers. These are seldom over 6 feet long and generally with few roots. They are planted with the growing

bud 2 or 3 inches above the surface of the soil, and for the first month are watered every four days, and later at longer intervals, as the season may demand.

There are thousands of seedlings called "degal," but these form a small proportion of the plantations and are recognized as bearing inferior dates. The market demand is for special uniform qualities, and these seedling dates are excluded because of their variability. A curious belief exists that date seeds, if immersed for a few seconds in water heated to nearly the boiling point before planting, will produce a much larger percentage of female trees than when planted in the ordinary way.

POLLINATION.

The dates were in flower in the middle of March at Mohammerah, and at Bahrein hundreds of female blossoms which had been already tied up with the sprig of male inflorescence inside were seen. Instead of tying about the female inflorescence a thin strip of palm leaf, as is done in Egypt and Algiers, the upper part was wrapped with a piece of the brown fibrous material which grows between the leaf and the trunk of the date palm. A single male tree yields sufficient pollen to fertilize the flowers of one hundred female trees, but there are especially productive male varieties whose pollen is more abundant, powerful, and has better keeping qualities than others. The names of three of these, as given by Mr. Raphael Sayegh, of Bassorah, to whom the writer is indebted for some valuable information, are: "Gunnami" (S. P. I. 8749[a]), "Wardi," and "Semaismi." Of these three, the first, "Gunnami," is considered the best, and is the only one which the old veteran date grower and buyer, Hadji Abdulla Negem, of Abu Kassib, would recommend for planting. At Maskat, or the date valley of Semail, in the interior, a special variety of male is planted, but so far as could be learned it has no name except that of "Fachl" (S. P. I. 8761[a]), which means "male." In the region back of Guadur, called Kej, the male variety in use is called "Gush" (S. P. I. 8763[a]). As young male plants of the best variety in each locality have been secured for introduction, it will be interesting to learn which sort will thrive best in America.

Whether or not the method of pollination which has been in practice for perhaps six thousand years is really the most economical one may be doubted, and some more effective way will possibly be discovered in the New World, which has already made so many improvements in methods of agriculture.

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[a] The numbers in parentheses are those given by the Office of Seed and Plant Introduction and Distribution, U. S. Department of Agriculture, to the specimens sent to America.

DIFFERENT VARIETIES OF THE REGION.

There are hundreds of varieties of dates in the Persian Gulf region, nearly every seedling being more or less different from its neighbor; but those which have been propagated by suckers and are more or less commonly known by the shippers number only about twenty or thirty. It would be foreign to the purpose of this paper to list all of these dates, although the time may come when it will be worth while to examine them all and to station an expert in the region during the fruiting season to search for superlative seedling sorts, or even with the hope of finding among the thousands of seedling trees a single one which bears a seedless fruit of fine quality. Seedless varieties which are not the result of imperfect fertilization are believed to exist. Mr. Sayegh showed the writer, in fact, on his own plantation, a single tree, unfortunately without suckers, which he says has regularly produced, even when properly pollinated, seedless dates of fair quality, though ripening late in the season.

The dates which are exported to the various European and American markets are not the most delicious varieties grown in Arabia and Persia, but simply good packing and shipping kinds. Different markets demand different varieties, and the principal market kinds for Europe and America are the "Halawi," "Khadrawi," and "Sayer" of Bassorah, the "Kursi" of Bagdad, and the "Fard" of Maskat. Indian and oriental markets call for quite different sorts from those known in America, generally of the dry and boiled class, and such kinds as the "Zehedi," "Brehm," "Chupchap," and "Mubsli" are exported to Bombay and Singapore, while for general home consumption the "Zehedi," of Bassorah and Bagdad, the "Gardiwahl" and "Murdasing," of Minab, and the "Batna" kinds grown along the coast of that name on the Gulf of Oman, are the commonest. Aside from these dates, which are good shippers, there are a large number of kinds which are highly prized for eating fresh from the tree—"rattab" as they are called in Arabic. The best of these are likely to prove of special interest to the date growers of America, where easy access to large cities will make the creation of a market for fresh table dates a possibility. Unfortunately, the notes secured on the comparative excellence of these different rattab varieties had to be taken second hand, as the visit of the writer to the Persian Gulf was made in March and the dates in this locality ripen from June to October. There are, further, no Europeans in the region whose interest in these fresh varieties has prompted them to make a study of their qualities. In the spelling of the different names, even, much variation exists, as it is often difficult to find the equivalent letter for an Arabic sound and all words are spelled phonetically. There is considerable variation in the Arabic pronunciation as well. The continental value of the vowels has been

taken in spelling the names in the list given below and the numbers which correspond with detailed descriptions that have been made out for the records of the Office of Seed and Plant Introduction and Distribution and which accompany young plants or seeds of the various sorts that have been sent to the United States Department of Agriculture or to the trial gardens in Arizona have been put opposite the names. The dried dates of some varieties have been secured to assist in the meager descriptions.

BAGDAD VARIETIES.

Kustawi. (S. P. I. 8738[a]). A medium to large, oblong, soft, sticky date, ripening in August, with stone of small size and little or no fiber or "rag." Skin a light golden brown, very delicate in texture and adhering to the soft golden flesh, which is of exquisitely rich, sweet date flavor. Too delicate for packing in the usual way, though keeping well until April. Said to be fairly productive, but a delicate tree, suited to adobe soils with an admixture of sand, and will withstand a temperature of 17° F., or possibly lower.

Ascherasi. (S. P. I. 8739.) A medium-sized, ovate, semidry date, ripening in September, generally not sticky, but easily handled without soiling the fingers. Stone small in comparison with the flesh. Some fiber, but not an objectionable amount. Skin of stem end dry, straw colored, but at tip translucent and of amber hue; of medium thickness and closely attached to the rather hard but sugary, sweet flesh, which is of excellent flavor. As seen in March in Bagdad, these dates are not packed in mat bags or boxes, but are sold in dry shape. Grown in adobe soil, and reported to be a vigorous sort, hardy at 17° F., or even lower, and in special favor among both Christians and Mussulmans, the former of whom, however, prefer it to all other sorts to eat with English walnuts.

Bedraihe. (S. P. I. 8740.) A small, ovate to oblong, dry date, ripening late in September. Not at all sticky, with good-sized stone, and more or less fiber about it. Skin straw color, with occasional translucent amber-colored spots near the tip; of parchment texture and sticking closely to the dry flesh, which is full of sugar. Not packed, but allowed to dry on the tree, though when fresh of soft consistency like ordinary sorts. Eaten as commonly by Bagdadians as any sort of date; easy of cultivation and capable of withstanding a winter temperature of 17° F., and possibly lower. Grown in adobe soil by irrigation.

Maktum. (S. P. I. 8741.) According to the description given the writer, a superior sort of the "Kustawi," but resembling it closely,

[a] The numbers in parentheses refer to the records of the Office of Seed and Plant Introduction and Distribution, U. S. Department of Agriculture.

being a soft, sticky date, with small stone, no fiber, and a beautiful golden-brown skin which adheres closely to the golden, brownish-yellow flesh. The sort ripens probably about the same time as the "Kustawi," i. e., in August, and is doubtless a delicate variety to cultivate. This date is considered by the Arab sheik Abdul Kader Kedery, of Bagdad, one of the best two sorts in Arabia.

Burni. (S. P. I. 8742.) A small, short, oblong date, ripening in July or August in Maskat. When fresh, highly appreciated as a table date, but generally boiled to form the "Karak pokhta" before fully ripe. Formerly shipped to America from Maskat. It is thought that this variety is of Maskat origin, for it is little known in Bagdad. It will probably prove more susceptible to cold than other sorts from Bagdad. Grown in adobe soils.

Zehedi. (S. P. I. 8743.) A small, oblong, dry date, ripening in September to October. Stone of medium size and surrounded with considerable fiber. Skin straw colored and tough, sticking closely to the dry but sweet, mealy flesh of fair flavor. Sometimes packed in bags or cases and called "Kursi," but generally allowed to dry on the tree. This is said to be the hardiest, most resistant to drought and alkali, and one of the most productive palms in the region. Although considerably inferior to the "Bedraihe," it nevertheless develops so quickly and yields so heavily that it is very commonly planted. Often sold fresh attached to the clusters as "Zehedi gus." In the form called "Kursi" it is of a golden-yellow color, but much inferior in flavor to "Kustawi" or "Khadrawi." One of the commonest dates in Bagdad.

Barhan. (S. P. I. 8744.) A date ripening at Bagdad, according to information given by a grower, in July, and of only mediocre quality. Very dark in color and not very sweet. Rarely cultivated in the region and not well thought of generally. Valuable principally for its early ripening habit and probable resistance to cold.

Sukeri. (S. P. I. 8745.) A very large date, 2 inches or more in length, and, when fresh, of excellent quality. Rarely cultivated and the writer could not learn much about it, except that it is not a good variety for shipment.

Taberzal. (S. P. I. 8794.) From dry specimens sent in, the writer was unable to obtain a good idea of this date, but should describe it as a small, oblong, soft variety, which ripens late in September. It has a small stone, no fiber (or at least extremely little), and a dark, amber-colored skin, which separates readily in dry specimens from the dark-brown flesh. The latter is of a caramel consistency, but has a most delicious flavor, and the variety can be eaten without soiling the hands, as the skin is quite dry. When fresh, said to resemble very closely the "Berhi," of Bassorah, though when dry there is scarcely any resemblance. A rare date in Bagdad, but very highly thought of

there. This fruit was not seen on the market and only seeds were obtainable during the writer's short stay, but suckers may possibly be obtained through correspondence with the United States vice-consul, Mr. Rudolph Hürner, of Bagdad.

Mirhage. A variety reported to be grown in Mandalay, some three days' journey from Bagdad. Sheik Abdul Kader Kedery, of Bagdad, said it was the finest date he knew, resembling the "Maktum," but of even finer quality. It was not obtainable during the writer's stay, but may possibly be had by correspondence with the United States vice-consul in Bagdad.

BASSORAH VARIETIES.

Berhi. (S. P. I. 8746.) Considered by many as the best soft date in the region. Of medium size, not so sticky as the ordinary dates, with small stone, no fiber, skin of amber to golden brown, of thin but firm texture, tightly attached to the soft, luscious, rich-flavored, brown flesh. The most productive of all sorts in the Bassorah region, according to Hadji Abdulla Nigem. Up to the present time not exported, but sure to form one of the highest-priced export dates to America because of its dry skin and exceptional lusciousness. An easy variety to cultivate, but requiring an abundance of water. Grown in a stiff adobe soil.

Herezi. (S. P. I. 8747.) A date resembling the standard market sorts like "Halawi," but of a much more delicious flavor. Samples sent to New York were pronounced by date buyers the finest dates they had ever tasted. Color light, size medium, ripening in September in Bassorah. A little-known sort from Abu Kassib, the Bassorah date center.

Sayer (or *Ustaamran*). (S. P. I. 8748.) A soft date of medium size and dark color, with medium-sized stone and a small amount of fiber. One of the sorts at one time exported to New York; now superseded by others. Said to do best on a light, sandy soil and to require less water than the ordinary varieties.

Halawi. (S. P. I. 8750.) There are probably as many bearing trees of this one sort in Mesopotamia as of any other, as it is the great shipping date and the favorite on American and London markets. It is a medium-sized, soft date, of sticky consistency, and ripens in September. The stone is medium to small; there is little fiber present, and the light-brown skin of delicate texture sticks closely to the flesh, which is abundant and of a deep-brown color, golden toward the stone. It possesses a strong date flavor and is of unusual sweetness. It is one of the best packing dates, as it keeps well and can be sent all over the world. A fairly productive sort, but confined in its culture to an adobe soil with plenty of water. It is not grown outside of the Bassorah region, it is said.

Khadrawi. (S. P. I. 8751.) A longer-shaped, darker-colored, softer date than the "Halawi," but ranking second among the export varieties and maturing in September. It is not of so rich a flavor as the Halawi, which it resembles in other respects, but may prove more adaptable to the conditions in Arizona and California.

HASSA VARIETIES.

The few hours spent in Bahrein, in the pearl islands, which lie 55 miles or so from Hassa, made it expedient for the writer to confine his attention to securing a single superlative variety, for which an arrangement was made through the kindness of the British Consul, Mr. Gaskin. There are doubtless inferior dates in Hassa.

Khalasa (or *Khalasi*). (S. P. I. 8753.) A medium-sized, ovate, sticky date, with small stone and no fiber, ripening as early as August in the region of Hassa. The skin is a golden brown and of most delicate texture, covering closely the rich golden flesh, which is of exquisite date flavor and with the consistency of a chocolate caramel. Said to be a delicate packer, and never exported except in the form of presents. It has the renown all over the Persian Gulf region of being the most delicious date in the world. Of its productiveness or hardiness little is known, but it is probable that a sandy will suit it better than an adobe soil, as it comes from the sandy region of Hassa, which is fed by underground water courses. This variety probably requires surface irrigation also.

JASK VARIETIES.

It was possible to learn only the names of the best dates grown in the interior behind Jask from the gardener of the Persian telegraph station at that place. They are called "Kharoo," "Shakari," "Nimkadami," and "Zarek," and the "Shakari" is said to ripen some of its fruits in May (?). The former director of the telegraph station, Mr. G. W. Mongavin, stated that at Bashkhara, five to six days' camel ride into the interior, some very superior dates are grown, but he could not give their names.

BUNDER ABBAS VARIETIES.

Minab is the date region of which Bunder Abbas is the nearest port, and according to the "dabach," or ship's chandler, who has lived in the region, the best-known sorts are the "Halawi," "Gardiwahl," "Murdasing," and "Fard." The most superior of these is said to be the "Murdasing."

MASKAT VARIETIES.

Fard. (S. P. I. 8754.) One of the commonest dates in the American markets. More than 1,000 tons are said to be exported from Maskat

every year, coming from the Semail Valley, 50 miles in the interior. A medium-sized date, longer and narrower than the "Halawi" or "Khadrawi," and belonging to the soft, sticky type. Stone medium large, with little fiber about it. The skin is of firm texture and dark brown in color, fitting closely to the deep amber-colored flesh, which is of a strong, rich, date flavor, but not of quite such fine texture as the "Halawi" or "Berhi." As a packing date it is the best in the region, although maturing late in the season for Maskat, i. e., in August. It is adapted to the hottest regions of America and probably to a sandier soil than that suited to the "Halawi."

Burni. (S. P. I. 8755.) See "Burni" of Bagdad (S. P. I. 8742) for the description of a date which the writer believes to be the same as this Maskat "Burni."

Nagal. (S. P. I. 8756.) A small, soft, sticky date, ripening before any other sort in Maskat—as early as June—and eaten exclusively as rattab or in fresh condition. It has a light-colored skin, and its flesh is inferior in flavor to "Fard," but it is keenly appreciated by Europeans as well as Arabs, because the first fresh date brought to the market. Of particular interest to American date growers, on account of its earliness, which may enable it to ripen good fruit farther north than the other sorts. Secured through the kindness of United States Vice-Consul Mackirdy at Maskat.

Mubsali. (S. P. I. 8757.) A long, narrow, unusually large variety, cultivated for boiling purposes. Stone large and with some little fiber about it. Prepared for market by boiling the still unripe fruits for an hour in water to which a large handful of salt per gallon has been added, and drying in the sun. After this preparation the flesh is hard and tastes like candy, but it is generally slightly astringent, particularly if improperly prepared. There is a large demand in India for this date, where it is used at wedding and other feasts, and big prices are paid for it, making it, it is said, the most profitable date grown about Maskat.

Khanezi. (S. P. I. 8758.) An almost globular date of the soft, sticky type, consumed locally in Maskat as rattab, ripening in July, and considered one of the best of the early dates. Not a packing sort, and keeping only a short time. From the valley of Semail, 50 miles in the interior.

Khassab. (S. P. I. 8759.) A soft, sticky date of red color, somewhat shorter than the "Fard" and ripening in August. Not shipped, but eaten fresh or soon after ripening. One of the heaviest yielders in the region, a single tree bearing, according to rough estimates, as much as 450 pounds. From the Semail Valley, and suited to culture in the hottest regions of the United States.

Hellali. (S. P. I. 8760.) A round date of the shape of an English walnut, but smaller, with light-yellow skin, borne in exceptionally

large bunches. A rare sort even in Maskat, consumed locally as rattab and considered by the inhabitants as of excellent quality.

GUADUR VARIETIES.

It was impossible to secure much information regarding the region inland from Guadur. The port is that from which Pangh Ghur and Kej are reached by caravan; the former is thirteen days', the latter only six days' journey. Through the kindness of Lieuts. W. H. Maxwell and W. O. Grant, of the First Baluchistan Light Infantry, stationed at Kurrachee, a native Baluchistan servant was sent as far as Kej and secured from Rostom Khan, younger brother of the Nazim, or native ruler of the province, a collection of young plants of the best varieties grown there. These were brought down to Guadur, accompanied with labels bearing the name only, and comprising twenty-four varieties, among which was the famous "Mozaty." The fruit of this sort is sent to Kurrachee sometimes as a delicacy, and is packed in small earthen jars preserved in the sirup of inferior dates. As eaten in Kurrachee in February they impressed the writer as the richest-flavored dates he had ever tasted. The following list is made up from the labels found on the palms, though there may have been some confusion of the names previous to the time of delivery of the plants:

Mozaty (or Mozati). (S. P. I. 8762.)
Gush, a male variety. (S. P. I. 8763.)
Apdandon. (S. P. I. 8764.)
Soont Gora. (S. P. I. 8765.)
Hashna. (S. P. I. 8766.)
Gonzelli. (S. P. I. 8767.)
Jalghi (or Jalka). (S. P. I. 8768.)
Bagum Jurghi (or Junghi). (S. P. I. 8769.)
Shukkeri. (S. P. I. 8770.)
Koroch. (S. P. I. 8771.)
Hallani. (S. P. I. 8772.)
Shapego. (S. P. I. 8773.)
Dishtari. (S. P. I. 8774.)
Chupshook (or Trupshook). (S. P. I. 8775.)
Korroo. (S. P. I. 8776.)
Rogani. (S. P. I. 8777.)
Churpan. (S. P. I. 8778.)
Kharba. (S. P. I. 8779.)
Dundari. (S. P. I. 8780.)
Subzoo. (S. P. I. 8781.)
Gond Gorbug. (S. P. I. 8782.)
Washclont (or Washclunt). (S. P. I. 8783.)
Kalara (or Kularu). (S. P. I. 8784.)
Hurshut (or Hurshud). (S. P. I. 8785.)

DISEASES AND PESTS.

Altogether, the palms of the Persian Gulf region are most remarkably healthy. So far as could be learned they suffer from no serious disease, and none of the shippers or growers could name a single malady which had at any time done much damage to their estates. On a few palms at Bassorah several leaves were observed that were attacked by a small ash-colored scale insect (*Parlatoria blanchardi* Targ. Tozz.), which is common in other parts of the world; but even this was doing little damage. In comparison with the palms of Egypt and Algeria they were most strikingly clean and healthy looking. The dry dates are often attacked in the storehouses by an insect (which the writer was

unable to see) which leaves an excrement in the cavity near the stone, but the soft varieties in this region were remarkably free from insects of any kind.

One might imagine that there would be during the date season a host of birds and small animals which would feast on the ripening dates, but curiously enough the growers were not able to name a single troublesome pest of this character. Even the date bird is not believed to live on the dates; at any rate does no serious damage.

The principal enemy of the date in Mesopotamia is the "shamál," a wind blowing across the desert laden with hot sand. If this occurs before the dates have sufficiently matured it dries them up and covers them with dust, checking their development and soiling them so that they are refused by the European and American importers. Last season's crop (1900) at Bassorah was seriously injured in this way, and the writer was told that the export was reduced from nearly 2,000,000 to about 1,000,000 cases.

COST AND PROFITS OF DATE CULTURE.

Twenty years ago in Mesopotamia handsome profits were made by Europeans in the date packing and shipping business, but of recent years the native-born Jews have learned how to pack, and have seriously reduced the gains to be made in date exporting. The representative of one of the largest concerns at Bassorah informed the writer that last year some of the packers actually carried on business at a loss in order to keep their brands on the market, and that very small profits were made by any of the firms. This was owing to the poor crop and a glutted home market, with many cases left over from the preceding year.

With the date grower, matters are somewhat different. His expenses for the maintenance of the garden are small and the cost of marketing the product slight, so that he realizes, according to a conservative estimate given by the manager of one of the large firms in Bassorah, on an average about 5 to 6 per cent profit. In an especially good year his profits might reach 10 per cent, but would hardly surpass this figure. It is next to impossible to find out how well date culture pays in this region, for the Arabs do not keep careful books of their expenses. From a reliable source, however, it was ascertained that one large proprietor netted last year—which was, however, an exceptionally bad season—less than 2 per cent on the estimated value of the estate. So it is evident that the profits of date growing on the Shat-el-Arab are no more sure than those of any other agricultural business.

The mudir, or business manager, of the Sultan's large estates at Amara remarked that the Turkish Government levies a tax of 2 piasters (about 8 cents) per year on every palm in Bagdad, 1¼ piasters in Amara,

and from 15 to 180 piasters per hundred palms in Bassorah, according to the location and bearing condition of the trees. This does not, however, in any sense represent the full amount of taxation to which a date planter is subjected, for there are many ways by which the rate of 10 to 15 per cent—which is commonly spoken of as prevailing—is made up. The methods of its collection and the hindrances to quick transactions form no inconsiderable part of the heavy yoke which is imposed upon the Arab landowner in his own land. The large landowner suffers less proportionately than the small one, for he can prevent the overappraisement to which the assessors subject the poor and ignorant peasant.

PACKING AND SHIPMENT OF DATES.

Dates are no doubt one of the stickiest, most difficult fruits in the world to keep clean, and the Persian Gulf varieties are perhaps particularly hard to pack in an attractive shape; but nevertheless the stories which one hears in the region of the conditions in the packing sheds and the personal uncleanliness of the men, women, and children who put up the dates are enough to disgust a sensitive person and to prevent his ever eating packed dates again without having them washed. No old inhabitant thinks of eating a date without first thoroughly washing it in a glass of water, unless the cook has prepared it beforehand, and the sale of dates in America might fall off decidedly were it generally known how intimately the unwashed hands, bodies, and teeth of the notably filthy Arabs often come in contact with the dates which are sold by every confectioner. Shippers claim they have tried better methods of packing but found that they did not pay, for the Persian Gulf date is expected to be obtainable for about 5 cents a pound. From the small pound boxes which were used last year it would seem that the packers have not yet learned the art of making them as attractive as the Algerian dates, which fetch as high as 40 cents for a box of less than a pound. It is probably true that the common varieties in this region are too full of sirup to pack well in the way that such a sort as the "Deglet Noor," of Algeria, is put up, but it is almost certain that varieties can be found which could be treated in a similar manner and could compete with this superlative sort of North Africa. The length of time which the fruit is allowed to hang on the tree has presumably something to do with the stickiness of the skin, for there are in Arabia dates of good quality with dry skins, which, when packed in the ordinary way, are indistinguishable from the ordinary sticky kinds. Under present conditions there is little prospect of any radical change being made in the old methods of packing.

Scarcely any of the packing firms own date plantations, but obtain their dates from the Arab landowners through trusted Arab buyers. Some of these buyers, who have been in the business for many years, are

intrusted with £10,000 to £20,000 in cash at a time, with which they purchase the tons of dates that are necessary to supply the packing sheds. As in most businesses of this kind, there are risks to be taken, for the packer must buy in August and sell in November, during which time the price may have fluctuated considerably. It requires good judgment to decide how much to pay in August for November delivery. The New York shipments to be most profitable must be in before Thanksgiving Day, and when this comes unusually early in the month the packers have their hands full to get their shipments through in time. Last season two steamer loads went direct from Bassorah to New York, and though, owing to the bad crop and glutted market, this venture did not prove a great success, the experiment will probably be made again the coming year.

THE DATE AS A FOOD.

The doctors seem agreed that sweet things in excess are injurious to the digestion, and the dentists claim that sugar ferments between the teeth, forming lactic acid which attacks the dentine; but for all this, it is doubtful if there can be found a sounder, stronger race, with better digestion and finer, whiter teeth than the date-eating Arabs. The town Arabs and the Arabs of the seacoast eat quantities of dried fish and other sea animals, but the denizens of the Arabian desert live almost exclusively upon dates and bread, with occasional feasts of sheep, goat, or chicken. Travelers across those deserts report that 3 pounds of dates and a few thin loaves of hard wheat bread per day will keep an Arab in good health for years. The quantity of these packed dates that a healthy Arab can consume at a sitting is astonishing. Two pounds would not be much more than an ordinary meal. The remarkable physique of the Arabs and their resistance to the almost unbearable heat of their country might be attributed, in part at least, to the nature of their simple food. At any rate, a thorough investigation of the food value of the date and its adaptability to the formation of foods for our hot summer season should be made, and possibly this wonderful vegetable product, which is now used in America only as a second-class confection, might be utilized as a basis of a nutritious new food. Such investigations will never be made in that part of the world where the dates are grown, but must be undertaken by some country like America which is interested in increasing the number of its food products.

PLATES.

DESCRIPTION OF PLATES.

PLATE I. (Frontispiece.) Fig. 1.—The old canal of Bassorah, which leads from the Shat-el-Arab River up to the town of Bassorah through plantations of date palms. Fig. 2.—A new plantation of dates at Bassorah, showing how closely to one another the irrigation ditches are run. Barley is grown on these areas in which the young palms have just been set. Fig. 3.—The border of the area at Bassorah which is watered by tidal irrigation. Patches of alfalfa grow on the newly irrigated areas.

PLATE II. Fig. 1.—An old date garden at Bagdad, the property of Sheik Abdul Kader Kedery, one of the richest date planters in the region. Fig. 2.—Irrigation ditches of a new plantation at Bassorah, showing the frequency of the canals, the nature of the soil, and in the background the primitive habitations of the date peasants. Fig. 3.—Typical village and date palms on the old Bassorah canal; in the foreground, the oriental gondola or "bellem," which is the principal vehicle of Bassorah.

PLATE III. Fig. 1.—A bag of Maskat dates, showing old method of packing for export. Fig. 2.—Typical date plantation at Abu Kassib, the most famous date center of Bassorah, belonging to Hadji Abdulla Nigem, the most noted date merchant of the region. Fig. 3.—Bassorah date peasant with his spade, the principal hand tool used in the date plantations of this region.

PLATE IV. Fig. 1.—Panorama, from Mr. Marine's house, of a new date area on the Shat-el-Arab River above Bassorah. The patches are planted with barley. Fig. 2.—Irrigation machines at work near Bagdad. In the foreground the ordinary primitive machine called a chird; in the background a more modern invention, resembling a chain and bucket pump, operated by horsepower. Fig. 3.—Intake of irrigation canal on the Tigris above Bassorah, showing how low the banks are and that no lifting of the water is necessary on this part of the river in order to fill the irrigating ditches. A Turkish guardhouse is seen on the left.

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FIG. 1.—OLD DATE GARDEN AT BAGDAD.

FIG. 2.—IRRIGATION DITCHES IN NEW PLANTATION, BASSORAH.

FIG. 3.—VILLAGE AND DATE PALMS ON THE OLD BASSORAH CANAL.

FIG. 1.—A BAG OF MASKAT DATES.

FIG. 2.—TYPICAL DATE PLANTATION AT BASSORAH.

FIG. 3.—BASSORAH PEASANT WITH HIS SPADE.

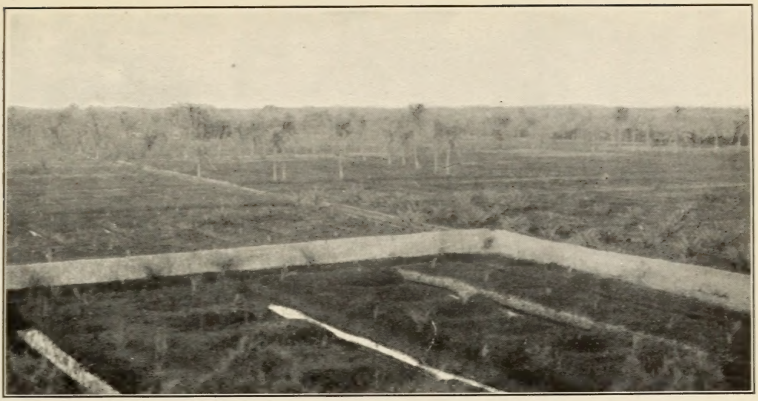

FIG. 1.—PANORAMA OF NEW DATE PLANTATION, NEAR BASSORAH.

FIG. 2.—IRRIGATION MACHINES ON THE TIGRIS, NEAR BAGDAD.

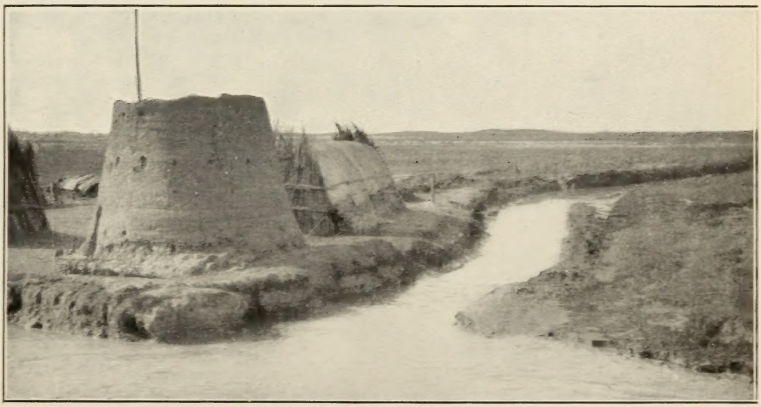

FIG. 3.—INTAKE OF IRRIGATION CANAL ABOVE BASSORAH.

[Continued from page 2 of cover.]

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[illegible] Apple in Cold Storage. 1903. Price, 15 cents.

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51. Miscellaneous Papers: Part I. The Wilt Disease of Tobacco and its Control. 1903. Price, 5 cents.

52. Wither-Tip and Other Diseases of Citrous Trees and Fruits Caused by Colletotrichum Glœosporioides. [In press.]

53. The Date Palm and its Utilization in the Southwestern States. [In press.]